

AMENDMENTS TO THE SPECIFICATION

IN THE ABSTRACT:

Please cancel the Abstract and replace it with the new Abstract attached hereto.

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IN THE SPECIFICATION:

Technology Center 2600

Page 15

~~Please replace the paragraph commencing at line 2 with the following amended paragraph:~~

Figure 20 shows wave forms of the liquid crystal voltage in the case where the operational amplifier 4601 has an offset voltage A that happens to be generated and the operational amplifier 4602 has an offset voltage B that happens to be generated. As shown in Figure 20, the deviations from respective expectation voltages vary depending on whether a voltage having positive or negative polarity should be outputted. Accordingly, the average voltage of the driving voltages that are applied to the liquid crystal display pixel contains a component of (A-B) indicative of the difference between the two deviations as an error voltage. The error voltage happens to be generated for every driving output

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terminals. This allows ~~to occur~~ the difference in the voltages applied to the respective pixels in the liquid crystal display apparatus. This to occur and causes the unevenness of display.

Pages 20-22

Replace the paragraphs commencing at page 20, line 24 through page 22, line 3 with the following amended paragraphs:

In Figure 25, the constant voltage source 115 is connected with the inverted input terminal 111 via the switch 107. In Figure 26, the constant voltage source 115 is connected with the noninverted input terminal 110 via the switch 107. Thus, the differential amplifier circuit uses the switches 106 through 109. This allows the circuit to switch between (a) the condition in which an offset that happens to occur due to the unevenness in the differential amplifier circuit is inputted to the inverted input terminal 111 and (b) the condition in which such an offset is inputted to the noninverted input terminal 110. According to such two kinds of conditions, the offsets of the noninverted output terminal 110 and the inverted output terminal 111 have a same absolute value and have polarities that are reversed to each other.

Thus, in the case where the operational amplifier has an offset voltage that happens to be generated due to the reasons such as the characteristic unevenness occurred by the manufacturing process, (a) the deviation from the expectation voltage when the offset voltage having positive polarity should be outputted and (b) the deviation from the expectation voltage when the offset voltage having negative polarity should be outputted are equal to each other. Accordingly, when the above operational amplifier is used in a liquid crystal driving circuit, there occurs no difference ~~of the~~ in the voltages that are applied to the respective pixels of the liquid crystal display apparatus. Thus, it is ensured to avoid the display unevenness.

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Pages 25-27

Replace the paragraphs commencing at page 25, line 23 through page 27, line 2 with the following amended paragraphs:

In Figure 30, the constant voltage source 615 is connected with the inverted input terminal 611 via the switch 607. In Figure 31, the constant voltage source 615 is connected with the noninverted input terminal 610 via the switch 607. Thus, the differential amplifier circuit uses the switches 606 through

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609. This allows the circuit to switch between (a) the condition in which an offset that happens to occur due to the unevenness in the differential amplifier circuit is inputted to the inverted input terminal 611 and (b) the condition in which such an offset is inputted to the noninverted input terminal. According to such two kinds of conditions, the offsets of the noninverted output terminal 610 and the inverted output terminal 611 have a same absolute value and have polarities that are reversed to each other.

Thus, in the case where the operational amplifier has an offset voltage that happens to be generated due to the reasons such as the characteristic unevenness occurred by the manufacturing process, (a) the deviation from the expectation voltage when the offset voltage having positive polarity should be outputted and (b) the deviation from the expectation voltage when the offset voltage having negative polarity should be outputted are equal to each other. Accordingly, when the above operational amplifier is used in a liquid crystal driving circuit, there occurs no difference ~~of the~~ in the voltages that are applied to the respective pixels of the liquid crystal display apparatus. Thus, it is ensured to avoid the display unevenness.

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Pages 29-30

Replace the paragraphs commencing at page 29, line 12 through page 30, line 22 with the following amended paragraphs:

Even in the case where there exists the discrepancy of the characteristics, that happens to occur due to the reason of the manufacturing process or other reasons, between the input transistors 1101 and 1102 that constitute the differential amplifier circuit, the structure similar to that shown in Figure 22 is realized although the detail is not described here. Thus, the differential amplifier circuit uses the switches 1106 through 1109. This allows the circuit to switch between (a) the condition in which an offset that happens to occur due to the unevenness in the differential amplifier circuit is inputted to the inverted input terminal 1111 and (b) the condition in which such an offset is inputted to the noninverted input terminal 1110. According to such two kinds of conditions, the offsets of the noninverted output terminal 1110 and the inverted output terminal 1111 have a same absolute value and have polarities that are reversed to each other.

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Thus, in the case where the operational amplifier has an offset voltage that happens to be generated due to the reasons such as the characteristic unevenness occurred by the

manufacturing process, (a) the deviation from the expectation voltage when the offset voltage having positive polarity should be outputted and (b) the deviation from the expectation voltage when the offset voltage having negative polarity should be outputted are equal to each other. This results in that the difference component between the two deviations is not remained as an error voltage in the average voltage of the driving voltages that are applied to the liquid crystal display pixels.

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Accordingly, when the above operational amplifier is used in a liquid crystal driving circuit, there occurs no difference of the in the voltages that are applied to the respective pixels of the liquid crystal display apparatus. Thus, it is ensured to avoid the display unevenness.

Pages 37-38

Replace ~~the~~ paragraph commencing at page 37, line 17 through page 38, line 10 with the following amended paragraph:

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When a signal of "L" level is applied to the switch changeover signal input terminal 1305, the switches 1308, 1309, 1312, and 1313 are turned on, in Figure 36. In this case, since a signal of "H" level is applied to the switch changeover signal input terminal 1304, the switches 1306, 1307, 1310, and 1311 are

turned off. The noninverted input signal at terminal 1302 is sent to the input transistor 1314 via the switch 1308. The inverted input signal at terminal 1303 is sent to the input transistor 1315 via the switch 1309. The gate signal is sent to the load transistors 1316 and 1317 via the switch 1313. The gate signal is sent to the output transistor 1318 via the switch 1312. In the case of Figure 36, the noninverted input signal is amplified by the circuit that is constituted by the input transistor 1314 and the load transistor 1316, while the inverted input signal is amplified by the circuit that is constituted by the input transistor 1315 and the load transistor 1317.

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Pages 40-42

Replace the paragraphs commencing at page 40, line 18 through page 42, line 6 with the following amended paragraphs:

When a signal of "H" level (high level) is applied to the switch changeover signal input terminal 1604, the switches 1606, 1607, 1610, and 1611 are turned on, because the switches are N-channel MOS type transistors as shown in Figure 38. In this case, since a signal of "L" level (low level) is applied to the switch changeover signal input terminal 1605, the switches 1608, 1609, 1612, and 1613 are turned off. A noninverted input signal

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at terminal 1602 is sent to the input transistor 1615 via the switch 1606. An inverted input signal at terminal 1603 is sent to the input transistor 1614 via the switch 1607. A gate signal is sent to the load transistors 1616 and 1617 via the switch 1610. A gate signal is sent to the output transistor 1618 via the switch 1611. In the case of Figure 38, the noninverted input signal is amplified by the circuit that is constituted by the input transistor 1615 and the load transistor 1617, while the inverted input signal is amplified by the circuit that is constituted by the input transistor 1614 and the load transistor 1616.

When a signal of "H" level (high level) is applied to the switch changeover signal input terminal 1605, the switches 1608, 1609, 1612, and 1613 are turned on, in Figure 39. In this case, since a signal of "L" level is applied to the switch changeover signal input terminal 1604, the switches 1606, 1607, 1610, and 1611 are turned off. The noninverted input signal at terminal 1602 is sent to the input transistor 1614 via the switch 1608. The inverted input signal at terminal 1603 is sent to the input transistor 1615 via the switch 1609. The gate signal is sent to the load transistors 1616 and 1617 via the switch 1613. The gate signal is sent to the output transistor 1618 via the switch 1612. In the case of Figure 39, the noninverted input signal is

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amplified by the circuit that is constituted by the input transistor 1614 and the load transistor 1616, while the inverted input signal is amplified by the circuit that is constituted by the input transistor 1615 and the load transistor 1617.

Page 48

Replace the paragraph commencing at line 7 with the following amended paragraph:

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The deviation between the first frame and the third frame and the deviation between the second frame and the fourth frame have a same value and have polarities that are reversed to each other, respectively. When the period (cycle) of the frame is enough short enough compared to the reaction time of the liquid crystal material, (a) the deviations are canceled between the first and third frames and (b) the deviations are canceled between the second and fourth frames. At the even-numbered output terminals, similarly, the deviations are canceled for every four frames. Table 1 shows the fact.

Page 50

Replace the paragraph commencing at line 17 with the following amended paragraph:

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However, since the circuit configuration requires two operational amplifiers for each output terminal, the problem that the scale of the circuit becomes large and its chip size becomes larger arises. In addition, since the number of the operational amplifier circuits whose power consumption is relatively large increases, the low power consumption is hard to be achieved.

Pages 54-55

Replace the paragraph commencing on page 54, line 23 through page 55, line 5 with the following amended paragraph:

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With the driving apparatus, the noninverted input signal and the inverted input signal are switched by the first changeover circuit, and the output signals of the first and second amplifier circuits are switched by the second changeover circuit, respectively. This switching allows to output the output signals that have been switched to the pixels provided in a matrix manner so as to drive the liquid crystal display apparatus.

Page 57

Replace the paragraph commencing at line 17 with the following amended paragraph:

A-12
The unevenness of the offset voltages for the respective liquid crystal output terminals is thus indiscernible by the human eyes. This is because the offset voltage is canceled in each pixel for the predetermined number of frames. This allows the circuit to carryout the display with good quality. Thus, it is possible to provide a driving method of liquid crystal display apparatus with extremely high reliability.

Page 69

Replace the paragraph commencing at line 1 with the following amended paragraph:

*A-13
Cont*
An output terminal of the 3-input NAND gate 5001 is connected with respective reset input terminals R₁ and a clock input terminal CK of the DF/F4 that realize a frequency divider circuit (2-frequency divider circuit) for dividing the frequency of the input signal to be 1/2. This allows the circuit to realize, with a simple circuit configuration, the frequency divider circuit that divides the frequency of the horizontal

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synchronizing signal so as to be 1/14. The output signals of the respective output terminals /Q and Q of the DF/F4 are outputted as the switch changeover signals SWP and /SWP for the operational amplifiers via inverters 5005 and 5006. Thus, the switch changeover signal SWP for the operational amplifier, that is inverted in synchronization with the rising of the horizontal synchronizing signal, is generated. Note that the /SWP in Figure 1 is a resultant of inversion of the switch changeover signal SWP for the operational amplifier.

Pages 89-90

~~Replace the paragraphs commencing at page 89, line 12 through page 90, line 13 with the following amended paragraphs:~~

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A driving apparatus of liquid crystal display apparatus in accordance with the present invention is provided with (a) first and second amplifier circuits that amplify a noninverted input signal or an inverted input signal, (b) a first changeover circuit that selectively switches and outputs the noninverted and inverted input signals to be outputted to the first and second amplifier circuits, ~~(b)~~^(c) a second changeover circuit that selectively switches and outputs output signals of the respective first and second amplifier circuits to pixels provided in a

matrix manner in accordance with an alternation signal, and
~~(e)~~^(d) a changeover control circuit that controls switching of
the first and second changeover circuits so that polarity of an
offset voltage to be applied to the pixel by the first and second
changeover circuits is changed for every predetermined number of
frames and the offset voltage is canceled by frames whose number
is twice as many as the predetermined number of frames.

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Cont'd*
When the driving apparatus, the noninverted input signal
and the inverted input signal are switched by the first
changeover circuit, and the output signals of the first and
second amplifier circuits are switched by the second changeover
circuit, respectively. This allows the circuit to output the
output signals that have been switched to the pixels provided in
a matrix manner so as to drive the liquid crystal display
apparatus.

Page 91

Replace the paragraph commencing at line 3 with the
following amended paragraph:

*A-15
Cont*
The unevenness of the offset voltages for the respective
liquid crystal output terminals is thus indiscernible by the
human eyes. This is because the offset voltage is canceled in

each pixel for the predetermined number of frames. This allows
A-15 the circuit to carry out the display with good quality. Thus, it
is possible to provide a driving apparatus of liquid crystal
display apparatus with extremely high reliability.
Amend

Pages 92-93

Replace the paragraph commencing at page 92, line 24 through page 93, line 20 with the following amended paragraph:

A-16 In this case, in response to the output signal of the logical product circuit, the signal (the output signal of the second frequency divider circuit), that varies in synchronization with the signal that is outputted for every horizontal synchronizing signal or for every horizontal synchronizing period, is outputted as it is as the second changeover signal or is inverted and outputted as the second changeover signal. In other words, the second changeover signal varies in synchronization with the horizontal synchronizing signal and reflects both (a) the discriminated result indicative of whether the number of the horizontal lines is an even number or an odd number and (b) the vertical synchronizing signal carrying the information about the frames. In accordance with the first and second changeover signals, the changeover control is carried out
Cont

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Amend

with respect to the inputs and outputs of the first and second amplifier circuits. This allows ~~that~~ the offset voltage to be applied to the pixel and is changed in its polarity for a predetermined number of frames and is canceled for the frames whose number is twice as many as the predetermined number of frames.

Page 94

Replace the paragraph commencing at line 14 with the following amended paragraph:

A-17

With the driving apparatus, the noninverted input signal and the inverted input signal are switched by the first changeover circuit, and the output signals of the first and second amplifier circuits are switched by the second changeover circuit, respectively. This allows the circuit to output the output signals that have been switched to the pixels provided in a matrix manner so as to drive the liquid crystal display apparatus.